I would like to begin today by explaining the structure of all the disease-specific talks during this program. Our main objective is to give you practical information on the vaccines you use every day. But to understand the rationale for these vaccines, you need to know a little about the microbiology, clinical features, and epidemiology of the diseases they prevent. We will not go into the diagnosis or treatment of these diseases. This information is available in other courses, and in many medical textbooks. All 2003 data are provisional, and reflect reporting from the 50 states, unless we tell you otherwise.

We are going to spend most of our time on the new, controversial, or confusing issues, particularly in this session when we focus on pertussis, polio, Hib, and pneumococcal disease of children. Because there are not many pressing issues with diphtheria and tetanus, our discussion of these diseases will be brief. We will include a discussion of the use of diphtheria and tetanus toxoids a little later in the program. There are chapters in the book on both tetanus and diphtheria in case you need to know more.

Diphtheria, Tetanus and Pertussis

Diphtheria is a disease you are not likely to ever see. But although it is rare in the United States, it is not gone. Because of this, and because it is more common in other countries, you need to be aware of it.

Diphtheria is caused by a bacterium called *Corynebacterium diphtheriae*. The bacteria infect mucous membranes, most commonly the nasopharynx. This leads to an exudative pharyngitis. As they grow, the bacteria produce a toxin that is absorbed into the bloodstream. The absorbed toxin causes most of the complications of diphtheria, such as myocarditis, or inflammation of the heart, and neuritis, which leads to abnormal nerve conduction. **Fewer than 6 cases of diphtheria have been reported each year in the U.S. since 1980**. Only 27 cases were reported from 1990 through 2002. **Most cases- more than half- occur among adults**. But the lack of cases does not mean the organism is gone. The **organism is probably still circulating in some areas of the United States**. In 1996, several infections with *Corynebacterium diphtheriae* were documented among people who had sore throats or ear infections. These infections occurred in a state where there had been a high incidence of diphtheria during the 1970s. Many physicians have never seen a known case of diphtheria. They may not even CONSIDER the diagnosis in a patient with membranous pharyngitis. Laboratories do not test for it unless a diphtheria culture is specifically requested. So the organism is probably still out there- we just do not see it because we are not looking hard enough.

Diphtheria remains endemic in many other parts of the world. During the 1990s there was a massive diphtheria epidemic in the former Soviet Union. This outbreak went on for years, and resulted in more than 5 thousand deaths. Several years of intensive international efforts have mostly controlled the outbreak, but cases continue to be reported in most countries of the former Soviet Union.

Could an outbreak happen here? Possibly. Estimates are that up to 40 percent of adults in the U.S. lack protective antibody for diphtheria. The message for you: make sure adults in your care and especially international travelers are up to date with diphtheria boosters.

Like diphtheria, TETANUS is rare in the U.S., so our discussion of it will be brief.

Tetanus is also an acute, often fatal, disease caused by a toxin produced by a bacterium called *Clostridium tetani*. The bacteria and their spores are found everywhere in the world that has dirt. We will NEVER eradicate tetanus. Tetanus is a terrible disease. The toxin blocks the impulses in certain nerves, which leads to unopposed muscle contraction and spasm. This is a photograph of a man with tetanus. This posture is typical of generalized tetanus. It is caused by massive spasm of the hamstring, gluteus, and paraspinal muscles. This newborn has neonatal tetanus. Because the mother was never vaccinated, she had no tetanus antibody to transfer during gestation, so the infant was born without passive protection. Newborns are usually infected as a result of unsanitary birthing practices.

The complications of tetanus include spasms of respiratory muscles which can lead to respiratory arrest. Muscle spasms can be so severe they break bones. One out of 4 persons who develop tetanus dies.

There are now fewer than 40 cases of tetanus per year in the U.S. Only 14 cases were provisionally reported in 2003. The disease occurs almost exclusively in adults. Neonatal tetanus is rare in the U.S., but is estimated to kill more than 200,000 newborns throughout the world every year.

Tetanus can only occur when the bacteria or their spores are introduced into the tissue of a susceptible person. So most cases are associated with injuries or wounds of some kind. This graphic shows the injuries and conditions reported in people with tetanus from 1998 through 2000, the last years for which we have compiled data. Wounds, like **punctures, lacerations, and abrasions** accounted for two thirds of the cases. Puncture wounds included stepping on a nail, splinters, injury from barbed wire, a tattoo, and a spider bite. **Chronic wounds**, such as abscesses and ulcers, accounted for 11% of cases. Fifteen percent of tetanus cases occurred among injection drug users, about a third of whom had no other known risk factor or injury. Twelve percent of cases occurred among people with diabetes. There was one case of neonatal tetanus reported. The child’s mother was unvaccinated because of a philosophic objection to

vaccination. The infant's umbilical stump was treated with bentonite clay at home. Fortunately, the child survived.

Tetanus and diphtheria are both caused by toxins, so immunity requires antibodies against the toxin. Antibodies against the bacteria themselves are not necessary. So the vaccine for both diphtheria and tetanus consists of formalin-inactivated toxin, known as a toxoid. We will talk about tetanus and diphtheria toxoid when we talk about DTaP vaccine.

There are more confusing issues with pertussis, so we will spend more time on it. The pertussis chapter starts on page 75 of your text if you want to follow along.

Pertussis is caused by the bacterium *Bordetella pertussis*. A vaccine has been available since the 1940s, and has largely controlled pertussis in developed countries. But pertussis still takes a huge toll worldwide, with an estimated 285,000 deaths in 2001.

Bordetella pertussis is a **gram negative bacillus** that produces **multiple antigenic and biologically active components**, some of which are shown on this graphic. The best characterized, and probably most important components are **pertussis toxin**, PT, and **filamentous hemagglutinin**, FHA. Other antigens include **adenylate cyclase, pertactin, and tracheal cytotoxin**. All of these antigens play some role in the pathogenesis of the disease, but not all of them are important for immunity to pertussis. One of the problems with pertussis has been the complexity of the organism, and an incomplete understanding of the disease process and immunity. Only in the last few years have investigators been reasonably certain which of these multiple antigenic products are most important for immunity to the disease. These discoveries led to the development of improved vaccines.

Pertussis is almost exclusively a respiratory disease. Lung infection leads to tissue damage. This damage may cause a decrease in pulmonary function, which leads to pooling of secretions and the characteristic cough. The **incubation period** of pertussis is relatively short. It is usually 5 to 10 days, but can be **as long as 21 days**. Initial symptoms are similar to a viral upper respiratory tract infection, with **insidious onset of a nonspecific cough**. **Fever is usually minimal throughout the course** of the illness. This first stage of pertussis is known as the **catarrhal** stage, and lasts 1 or 2 weeks. The cough gradually worsens, and the patient enters the **paroxysmal cough** stage, in which the typical severe episodes of coughing occur. The paroxysmal stage may last from 1 to 6 weeks. The cough then slowly subsides, and **convalescence** may take weeks to months.

The characteristic whoop of pertussis is the result of a strong inspiratory effort against a closed glottis. The sound of a whoop, and the misery of a child with full blown pertussis, is something you do not quickly forget once you have seen it.

These paroxysms of coughing may occur up to 30 times a day, and may be severe enough to cause cyanosis. A paroxysm of coughing typically ends with vomiting, and the child usually looks exhausted. Between attacks, the patient may not look very ill, and is usually comfortable.

Pertussis is not just a childhood disease, as was believed in the past. Studies conducted during the last 10 years show that pertussis is common in adults. A recent large study estimated that pertussis **accounts for up to 7% of cough illnesses per year** among adults 15 to 65 years of age. This means up to a million cases of pertussis per year in this age group. The disease in adults is **often milder than in infants and children**, and adults may not have paroxysms or a whoop. Pertussis is usually not considered by the provider. Infections in adolescents and **adults are often the source of infection for susceptible children**.

Because pertussis is predominantly a respiratory disease the most frequent complication is **pneumonia.** This complication occurs in about 5 percent of reported cases. Other complications include **seizures** in about 1 percent, and **encephalopathy** in zero point 1 percent, or once per thousand reported cases. The cause of encephalopathy is not known with certainty. Some experts think it is due to hypoxia, others believe a toxin may be involved. About 20 percent of reported cases require **hospitalization**. **Death** occurs in about zero point 2 percent, or 2 per 1,000 cases, and is usually due to pneumonia. In 2000 alone 17 deaths from pertussis were reported. The frequency of complications of pertussis varies inversely with age. The most severe disease and complications are reported among infants and young children. Of the 62 pertussis-related deaths reported in 1997 through 2000, 56, or 90%, occurred in infants 6 months of age or younger.

The epidemiology of pertussis is complicated because of its high infectivity and atypical presentation in older children and adults. **Humans are the only reservoir** for pertussis. **Transmission is by direct contact with respiratory droplets** from an infected person. **Maximum communicability occurs in the catarrhal stage**, when it seems like just a cold, before the characteristic cough develops. People may transmit the disease in the paroxysmal stage as well. Pertussis is very contagious. The **secondary attack rate among household contacts is as high as 90%**, which means that a person with pertussis will infect almost every susceptible person in the house.

This graph shows the number of reported cases of pertussis by year from 1940 through 2003. Notice the scale of the vertical axis – 250,000 cases. Between 1940 and 1945, an average of 175,000 cases and 2,700 deaths from pertussis were reported each year. With the widespread use of pertussis vaccine in the late 1940s, the number of reported cases began to drop, although not as rapidly as with some other diseases. Notice that cyclic peaks occurred every 2 to 5 years, even as the incidence was falling. This graph shows the number of reported cases by year since 1980. Notice that we are using a totally different scale on the vertical axis. The top is 10,000, not 250,000 like the last graph. The

cyclic peaks continue to occur. Notice the peaks in 1985, 90, 93, 96, and 2003. A provisional total of 9,771 cases was reported in 2003, the highest annual total since 1964.

Pertussis vaccination rates have increased substantially since 1996. So why has the number of reported cases not declined? The answer to this question may be in WHO is being reported with pertussis. This graph shows the age distribution of reported cases of pertussis from 1997 through 2000. During these years, the largest number of cases was reported in persons 10 to 19 years of age. This group accounted for almost 30 percent of all reported cases. Almost half of reported cases were among persons 10 years of age or older. Although persons 10 years and older accounted for the largest PROPORTION of cases, infants had the highest RATES of pertussis, by far. The rate among infants less than a year of age was 56 per 100,000 population, more than 10 times higher than the rate among persons 10 to 19 years of age. Compared with pertussis surveillance data from 1994 through 1996, pertussis incidence rates among adolescents and adults has increased by 60 percent. This increased incidence in older children could be partly due to changes made in the surveillance definition of pertussis. But it could also be due to increased recognition and diagnosis of pertussis among older age groups.

One factor that may be contributing to the rise in pertussis among older children and adults is waning vaccine induced immunity. Protection declines as you get further away from the time you had your last dose. After 10 years, vaccine induced immunity is probably minimal. At this point, even vaccinated people may develop mild or undiagnosed disease that could be transmitted to incompletely vaccinated infants.

So – has there been a true rise in pertussis in the last decade? Yes, probably. This rise may be due in part to better surveillance. Waning immunity among adolescents and adults probably contributes as well. It is possible that in the future pertussis vaccination of older people could help protect infants and further decrease the burden of pertussis in this country

Pertussis has a much longer history than most vaccines we use today. The development of pertussis vaccines began in 1906, when *Bordetella pertussis* was first grown on artificial media. The first crude pertussis vaccines were attempted about the time of the First World War. During the next 20 years, production techniques were perfected, which led to the second generation of vaccines.

Improved pertussis vaccines were **developed in the mid 1930s**, and **combined with diphtheria and tetanus toxoids as DTP since the mid 1940s**. These were whole cell vaccines, made from a suspension of formalin inactivated *Bordetella pertussis* cells. **Whole-cell pertussis vaccines were effective**, but half of doses were associated with **local reactions**, such as redness, swelling, or pain. Systemic reactions like **fever** were also common. The desire to reduce adverse reactions following pertussis vaccination led to the development of a

new generation of more purified vaccines in the 1990s. These vaccines -- called acellular, since they do not contain whole pertussis cells – were **licensed** for the **primary series in 1996**. Acellular vaccines are the only pertussis vaccines available in the United States. Whole cell pertussis vaccines are no longer distributed in this country, so we will not discuss them further in this program.

Acellular pertussis vaccines are available only as combined DTaP. Single antigen acellular pertussis vaccine is not available. No DTaP vaccine in the U.S. contains thimerosal as a preservative. There are currently three DTaP products available in the United States: **Tripedia**, produced by Aventis Pasteur; **Infanrix**, produced by Glaxo Smith Kline; and **Daptacel**, also produced by Aventis. Two of these vaccines are also included in combination products, which we will discuss a little later. It is important to realize that these vaccines are different, even though they share some similarities. They contain a different number of antigens, in different concentrations. The antigens are manufactured and combined in different ways. Here is a table that illustrates this. It lists the vaccines and the quantity of each antigen they contain, in micrograms. **Tripedia** contains two components, pertussis toxin, or PT, and filamentous hemagglutinin, or FHA, in approximately equal amounts. **Infanrix** contains 3 antigens, mostly PT and FHA. **Daptacel** contains less PT, FHA and pertactin than the other two vaccines, but contains an additional antigen, called the fimbria antigen.

These vaccines have been studied in either blinded cohort studies or in case control studies. All three vaccines have an estimated vaccine efficacy of 80% to 85% against typical pertussis disease. Although the vaccines contain a different number and amount of pertussis antigen, there is no clear evidence that one is significantly more effective than the others. As a result, neither ACIP nor AAP has stated a preference for one of these vaccines.

DTaP vaccine is recommended for all infants and children without contraindications. We will discuss contraindications to vaccination in a few minutes. A primary series in infancy is 4 doses, beginning at about 2 months of age. The first 3 doses are usually separated by 2 months. The **fourth dose** should follow the third by at least 6 months, and should be given at 15 to 18 months of age. If an accelerated schedule is needed, the first dose can be given at 6 weeks of age, with the second and third doses given at 4 week intervals.

DTaP can and should be given simultaneously with all other childhood vaccines using a separate syringe and at a separate site. We receive many questions about the appropriate age for the fourth dose of DTaP. According to the package inserts- and ACIP **recommendations- the fourth dose should be administered at 15 to 18 months** of age. But ACIP also states that the fourth dose may be given earlier than 15 months in certain circumstances. Specifically, the fourth dose **may be given earlier than 15 months of age** if the **child is at least 12 months** of age, AND it's been at least **6 months since the third dose** of pertussis vaccine, AND in your opinion the child is **unlikely to return for an additional visit at 15 to 18 months of age**. The fourth dose of the DTaP series should not be administered prior to the first birthday. Also, the minimum interval

between the third and fourth doses is six months. The fourth dose of the series should not be given less than 6 months after the third dose even if the child is a year old. One additional note: the fourth dose of Daptacel is approved for use at 17 to 20 months of age. It is licensed this way because that is how the company requested it be licensed in their application to FDA. Despite this, ACIP recommends that Daptacel be administered on the same schedule as the other two DTaP vaccines.

The age and timing of the dose at school entry can also be confusing. A **fifth dose at 4 to 6 years of age is recommended when the fourth dose is given before age four years**. **Tripedia and Infanrix are licensed for the fifth dose after a DTaP series.** It is likely that Daptacel will be approved for all 5 doses in the future. The fact that only two of the three available DTAP vaccines are approved for the fifth dose can put you in a difficult situation. What if you only stock Daptacel, which is not approved by FDA for the fifth dose? You would be forced to use Daptacel off-label- that is, in a manner not approved by FDA – or use another brand, or not give an eligible child the fifth dose, or stock the other two vaccines just for fifth doses. In November 2000, ACIP published supplementary recommendations on the use of DTaP that provided guidance in this situation. In ACIP's opinion, it is preferable to use DTaP for an off label use rather than miss the opportunity to administer the fifth dose of the series.

Data on the interchangeability of the three DTaP vaccines is not available. ACIP recommends that **whenever feasible, the same DTaP vaccine be used for all doses of the series**. But if the brand of **vaccine used for the earlier doses is not known or not available, then any brand may be used to complete the series**, even if that brand is not specifically approved for the fifth dose. Let me repeat this to make sure you are clear. Tripedia and Infanrix are currently licensed for the fifth dose after 4 doses of DTaP. If you have Tripedia or Infanrix in stock, you should use one of them for the fifth dose. If you only have Daptacel in stock, and a child is eligible for a fifth dose, use it to complete the series. Do not miss the chance to complete the series. It is better for a child to complete the series with a different vaccine than to not complete it at all. This same principle applies to all the other doses in the DTaP series. Use the same vaccine for all doses of the series if you can. But do not hesitate to administer a different brand if you do not have the brand used for earlier doses in stock.

There are two combination vaccines currently available that include DTaP. One vaccine – **Trihibit** -- contains DTaP and Hib. This vaccine is currently **licensed only for the fourth dose of the DTaP and Hib series**. It is not licensed for the first three doses because of concerns about the immunogenicity of the Hib component when it is mixed with DTaP. It may also be **used as the booster or final dose following a series of single antigen Hib vaccine** or following Comvax, the combination hepatitis B-Hib vaccine. It is possible that a DTaP and Hib combination vaccine may be available for the entire series in the future. But Trihibit is not licensed for this use now, and should not be used for the first three doses of the series.

In December 2002, the US Food and Drug Administration approved a new combination that **contains DTaP, inactivated polio and hepatitis B vaccines.** The vaccine is called **Pediarix,** and is produced by GlaxoSmithKline. The DTaP component is Infanrix, and the hepatitis B component is Engerix-B, which were previously licensed in the U.S. Pediarix is **approved for the first three doses** of the DTaP and IPV series, which are usually given at about 2, 4, and 6 months of age. It is **not approved for the fourth or fifth doses** of the DTaP series. The **minimum age for the first dose of Pediarix is 6 weeks**. So it cannot be used for the birth dose of the hepatitis B series. Pediarix is also **not approved for use in infants born to women who are hepatitis B surface antigen positive or whose hepatitis B status is unknown**. We will discuss this issue again when we talk about hepatitis B vaccines. An important fact to remember about Pediarix, and all other combination vaccines for that matter, is that the minimum intervals between doses are dictated by the single antigen with the longest minimum intervals. Therefore, Pediarix minimum intervals are determined by the hepatitis B component. As for hepatitis B vaccine, the minimum interval between the first two doses of Pediarix is 4 weeks. The third dose must be administered at least 8 weeks after the second dose, and should follow the first dose by at least 16 weeks.

Here is a scary thought: once children reach 7 years of age, they become adults – at least as far as pertussis vaccine and diphtheria toxoids are concerned. **Acellular pertussis vaccine is not approved for anyone 7 years of age or older**. At age 7 you also stop using pediatric diphtheria toxoid and switch to the adult formulation, which contains one third as much antigen as the pediatric formulation. **People 7 years of age and older should receive only adult tetanus diphtheria toxoid -- Td**. This includes children who have not completed a full series of DTaP. Once a child turns seven, no more pertussis vaccine, and no more pediatric DT. **Any incomplete tetanus diphtheria series should be completed with adult Td**.

Tetanus and diphtheria toxoids are very immunogenic. A full series of either toxoid will induce protective antibody in nearly 100% of recipients. Duration of protective antibody titer following a complete series is at least 10 years. Here is the schedule for primary immunization in persons seven years of age or older. The primary series is 3 doses of adult Td, with the first 2 doses separated by at least four weeks, and the third given at **6 to 12 months** after the second. A **booster dose should be routinely administered every 10 years thereafter**. Children who completed their DTP, DTaP or pediatric DT series on schedule should receive their first booster dose of Td at 11 or 12 years of age. But at least 5 years needs to have passed since the last dose.

The main reason that acellular pertussis vaccines were developed was to reduce adverse reactions.

The desire to reduce adverse reactions resulting from whole cell pertussis vaccines was the driving force behind the development of acellular vaccines. As with other inactivated vaccines, the most common adverse reactions following

DTaP, DT, and Td are **local reactions**, such as swelling or redness. The more doses a person has received, the more likely they are to have a local reaction. Up to 85% of recipients of booster doses of Td will report some pain or tenderness at the injection site. Arthus, or so called hypersensitivity reactions are sometimes seen following DTaP or adult Td, and they are usually attributed to the diphtheria or tetanus component. Hypersensitivity is a misnomer, since these reactions are not allergic, as that name implies. They are basically exaggerated local reactions. Exaggerated local reactions occur in people who have received frequent Td doses or boosters, and have very high levels of circulating antibody. These reactions are NOT contraindications for further doses, because the antibody wanes. Just be careful to give boosters at the appropriate intervals. **Low grade fever** may occur after DTaP but is not common after Td. **More severe systemic adverse reactions**, such as fever of 105 or higher, persistent crying, and hypotonic episodes are not common. These unusual reactions are associated with pertussis vaccine, and have been reported following DTaP. These reactions were more common after whole cell vaccine, which is no longer available in the U.S. Encephalopathy, which was a very rare adverse reaction to whole cell, pertussis vaccines, has not been associated with acellular vaccine. Data on the use of a single DTaP vaccine for the complete 5 dose series are limited because infants who began the series with DTaP have only recently become eligible for the fifth dose. So information on adverse reactions following a full series of DTaP are also limited. Available data suggest an increase in the frequency and magnitude of local reactions with both the fourth and fifth doses compared to the first three doses. Here is an example. This graph shows the percentage of children reported with swelling, pain or fever of 101^{o} Fahrenheit or higher following administration of Tripedia. The **green** bar represents reactions following the first dose, and the **tan** bar reactions following the fourth dose. Reports of these reactions were substantially higher following the fourth dose of the series. For instance, swelling at the site of injection increased from 2% after the first dose to 29% following the fourth dose. Although the data shown in the graph are for Tripedia, it appears that **local reactions and fever are increased following the fourth and fifth doses** of all brands of DTaP. In addition to these local reactions, there have also been **reports of swelling of the entire limb** after both the fourth and fifth doses. The cause and frequency of these unusual reactions is not known, but they appear to be **self-limited and resolve without sequelae**. Parents should be informed of the increase in local reactions that has been reported following the fourth and fifth doses of DTaP. ACIP continues to recommend that a fifth dose of DTaP be administered before a child enters school. Because of the importance of this dose in protecting a child during school years, ACIP recommends that a history of extensive swelling after the fourth dose should NOT be considered a contraindication to receipt of a fifth dose at school entry.

The contraindications and precautions to DTaP are the same as they were for whole-cell pertussis vaccine. A **severe allergic reaction to a vaccine component or following a prior dose** is a contraindication to DTaP, pediatric DT, adult Td, and every other vaccine. **Encephalopathy occurring within 7 days after vaccination** is a contraindication to further doses of pertussis-containing vaccine. This contraindication is a remnant from the whole-cell

pertussis days. As mentioned earlier, encephalopathy has not been associated with acellular vaccines. Here are the **precautions** for DTaP. As with all other vaccines **moderate or severe acute illness** is a precaution, and vaccination should be deferred until the acute condition improves. If any of the next four events occur following PERTUSSIS vaccination, then additional doses generally should not be given: **temperature of 105^{o} Fahrenheit** – that is 40.5^{o} Celcius -- within 48 hours with no other identifiable cause. **Collapse or shock like state**, also known as a hypotonic hyporesponsive episode within 48 hours. **Persistent inconsolable crying lasting 3 hours or more** within 48 hours. And **convulsions with or without fever occurring within 3 days**. All of these precautionary conditions have been reported following both whole cell and acellular pertussis vaccines. While they are scary, they do not result in permanent injury. DTaP has not been associated with ANY permanent brain injury. If one of these reactions occurred following a dose of any type of pertussis vaccine, you would not usually give additional doses. The series would be completed with pediatric DT. But remember that precautions require your judgment. You need to determine if the benefit of pertussis vaccine outweighs the risk of a recurrence of the adverse reaction. If so, you may choose to give the vaccine. For example, one of your patients is a normal 6 month old who had a fever of 105 the day after his second DTaP. Now there is a large community-wide pertussis outbreak going on. You may choose to vaccinate this child because the risk from disease exceeds the risk from vaccination.

You have probably encountered older persons who claim to be allergic to tetanus shots. Many describe severe reactions to something they were given for tetanus years ago. Their allergic reactions may actually have been serum sickness, a reaction to equine antitoxin. Equine antitoxin was the only product available for the prevention of tetanus prior to the mid 1940s. It was used for postexposure prophylaxis until the late 1950s, when tetanus immune globulin was introduced. Tetanus toxoid has never contained any horse protein. If you come across someone with a history like this, do not just write it off as allergy to tetanus toxoid. Try to find out when it happened, the nature of the reaction, and the circumstances when it occurred. If the reaction seems to be truly anaphylactic, you should strongly consider referring your client to an allergist for evaluation. No one should be allowed to walk around susceptible to tetanus. That can be a fatal error.

Waning immunity in older children and adults could be part of the problem with pertussis. There is no pertussis vaccine licensed for persons 7 years and older right now. But studies have shown that acellular pertussis vaccine is safe and immunogenic among adults. What is not clear is whether giving acellular pertussis vaccine to older children and adults will actually reduce the risk of their becoming INFECTED with pertussis, or reduce the risk of transmitting pertussis to young children. A pertussis vaccine for adults was recently approved in Canada, and may be available in the U.S. in the future.